Software Quality Assurance:

Quality (What, Why and Cost)

What is Quality?

- Conformance to explicitly stated functional and performance requirements,
- explicitly documented development standards, and implicit characteristics that are expected of all professionally developed software (Pressman)
- The degree to which a system, component, or process meets specified requirements , customer or user needs or expectations (IEEE)

Why Quality?

- You would not like MS Office to occasionally save your documents, Competitiveness of International Market

Cost of Quality:

- Although all errors cannot be removed, more than a third of these costs, or an estimated $22.2 billion, could be eliminated by an improved testing infrastructure that enables earlier and more effective identification and removal of software defects. (US Dept of Commerce, 2002)

Some Definitions

- **Quality**: The totality of features and characteristics of a product, process of service that bears on its ability to satisfy stated or implied needs.
- **Software Error**: A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition. This can be a misunderstanding of the internal state of the software, an oversight in terms of memory management, confusion about the proper way to calculate a value, etc.
- **Software Failure:** The inability of a system or component to perform its required functions within specified performance requirements. See: bug, crash, exception, and fault.
- **Bug**: A fault in a program which causes the program to perform in an unintended or unanticipated manner. See: anomaly, defect, error, exception, and fault. Bug is terminology of Tester
- **Defect**: Commonly refers to several troubles with the software products, with its external behavior or with its internal features.
- **Fault**: An incorrect step, process, or data definition in a computer program which causes the program to perform in an unintended or unanticipated manner. See: bug, defect, error, exception.

Default Document for Quality

- Against which we test if they are met
- We refer to theses quality features and characteristics as Quality Attributes
- They are part of the Software requirements specification (SRS) document
- We employ Quality Control Techniques, Measurements, and Inspection techniques for this purpose

Typical Quality Assurance Attributes

- Non-functional Requirements
- Product transition related (Portability, Interoperability, Reusability)
- Product Operations related (Reliability, Robustness, Efficiency, Usability, Safety, Security, Fault-tolerance
- Product revision related (Maintainability)

Quality Assurance vs. Quality Control

- **Quality Assurance**
- Fault prevention through process design and auditing
- Creating processes, procedures, tools, jigs etc., to prevent faults from occurring

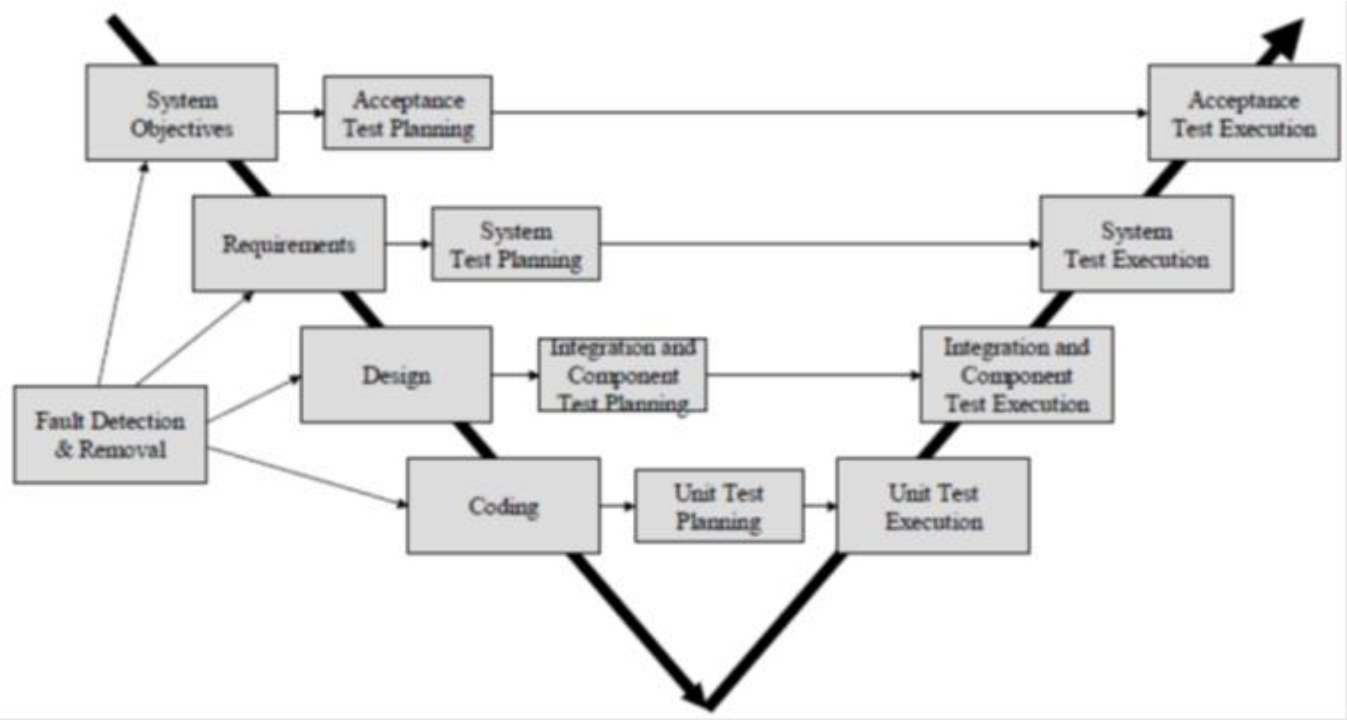
Quality Control

- It is fault/failure detection through static and/or dynamic testing of artifacts
- It is examining of artifacts against pre-determined criteria to measure conformance

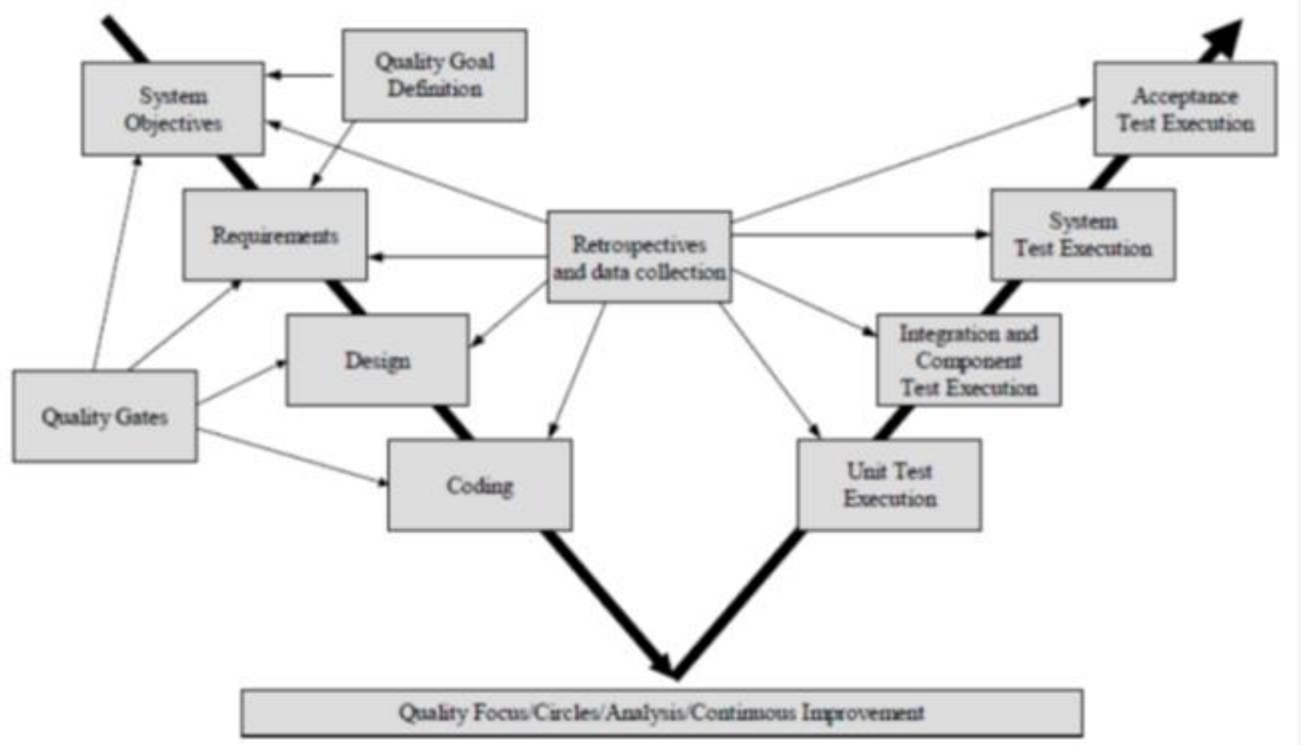
Quality Control Methods

- Reviews (Personal, peer, pair, management, QA, independent)
- Testing Structural, functional, integration, stress/performance, regression, field, acceptance
- Simulations (Prototypes, models)
- Field Trials (Prototypes, beta testing)
- Mathematical (Proofs of correctness)

QC in Software lifecycle



QA in Software lifecycle


Quality Goal Definition
System Objectives
Requirements
Retrospectives and data collection
Acceptance Test Execution
System Test Execution
Design
Integration and Component Test Execution
Quality Gates
Coding
Unit Test Execution
Quality Focus/Circles/Analysis/Continuous Improvement

Quality Standards ISO 9000 standards, Capability Maturity Model (CMM)

Quality Planning

○ Software quality engineering is driven by the software quality plan

○ A quality plan is a document setting out the specific quality practices, resources and activities to particular product, process, service, contract or project

○ Quality plan (Sets out the desired product qualities, and define how these are to be assessed)

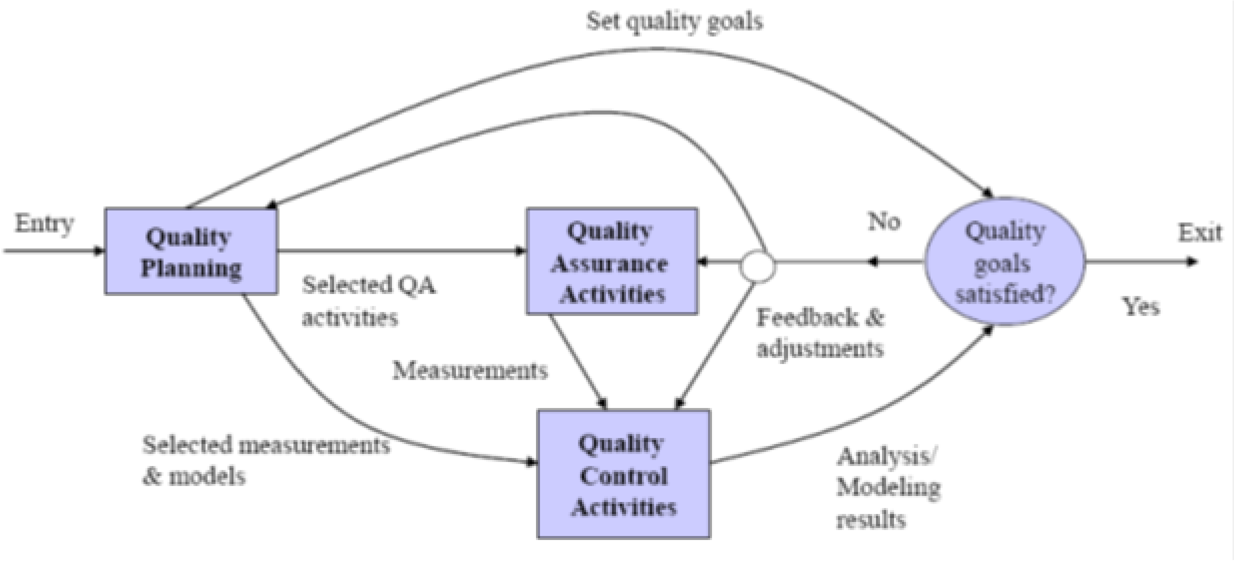
○ Select those organizational standards that the appropriate to a particular process and development processes

Quality Engineering Process

○ Iterative process which combines quality planning, quality assurance and quality control activities.

○ Our goal is

- Defect prevention,
- reduction and
- containment


Set quality goals
Entry
Quality Planning
Selected QA activities
Quality Assurance Activities
No
Quality goals satisfied?
Exit
Yes
Feedback & adjustments
Measurements
Selected measurements & models
Quality Control Activities
Analysis/ Modeling results